

A condition of the eyes in which vision is normal in daylight or other strong light but is abnormally weak or completely lost at night or in dim light. The condition may result from vitamin A deficiency, disease, or hereditary factors. Also called nyctalopia.

Definition

Night blindness is the inability or reduced ability to see in dim light or darkness. It also refers to the condition in which the time it takes for the eyes to adapt to darkness is prolonged.

Description

Night blindness, also called nyctalopia, is a symptom of several different diseases or conditions. All of the possible causes of night blindness are associated with the way in which the eye receives light rays. Light travels through the cornea and lens and lands on the retina at the back of the eye. The retina is composed of photoreceptors. Photoreceptors are specialized nerve cells that receive light rays and convert them into electrical signals, which are then transmitted to the brain, creating an image.

There are two types of photoreceptors, rods and cones. There are three million cones and 100 million rods in each eye. The two different photoreceptors are similar in structure, however, rods have a larger outer segment than cones. The outer segments of photoreceptors contain light-sensitive photopigments which change shape whenever light rays strike them. Rods contain the photopigments retinal and rhodopsin, whereas cones contain retinal and three different opsins. Rhodopsin is only able to discriminate between different degrees of light intensity, whereas the opsins of cones distinguish between light wavelengths in the red, blue, and green ranges. Hence, rods see only black and white, but cones see colors. Also, rods enable the eyes to detect motion and provide peripheral vision.

Rods are responsible for vision in dim light, and cones are responsible for vision in bright light. The rods are spread throughout the retina, but the cones are only in the center of the retina. Vision in dim light or darkness is blurry because of the connections between the photoreceptors and the nerve cells which are linked to the brain. Each rod must share this connection to the brain with several other rods so the brain does not know exactly which rod produced the signal. Alternatively, vision in bright light is sharp because each cone has its own connection to the brain so the brain can determine exactly where on the retina the signal originated.

Another feature of rods is that they must adapt to darkness. This is best exemplified by walking into a dark movie theater. At first, one can see very little. With time, vision improves and one is able to discern objects. Ultimately, one can see moderately well. This dark adaptation process occurs because of the chemical nature of rhodopsin. Rhodopsin is decomposed in bright light making the rods nonfunctional. In darkness, rhodopsin is regenerated faster than it can be decomposed. Dark adaptation takes about 15–30 minutes and, when complete, increases light sensitivity by about 100,000 times.

Causes & Symptoms

Several different conditions and diseases can cause night blindness. These include:

Cataracts. This condition is characterized by a cloudiness of the lens.

Congenital night blindness. This is an inherited, stable disease in which persons suffer from night blindness. Recent advances in gene mapping have identified several mutations responsible for this form of night blindness.

Liver conditions. Reduced night vision can be linked to poor liver functioning, due to a variety of conditions, which impairs vitamin A metabolism.

Macular degeneration. Degeneration of the macula retinae, a specialized region of the retina, can cause night blindness.

Retinitis pigmentosa. This is an inherited eye disease in which there is progressive deterioration of the photopigments of the photoreceptors, eventually resulting in blindness. The rods are destroyed early in the course of disease resulting in night blindness. Night blindness in children may be an early indicator of

retinitis pigmentosa. Recent genetic studies have identified mutations related to retinitis pigmentosa on human chromosome 19.

Vitamin A deficiency. Night blindness is commonly caused by a deficiency in vitamin A, in fact, it is one of the first indicators of vitamin A deficiency.

Xerophthalmia. This condition is characterized by dryness of the conjunctiva (the membrane that covers the eyelids and exposed surface of the eye) and cornea, light sensitivity, and night blindness. It is caused by vitamin A deficiency. Xerophthalmia rarely occurs in countries with adequate supplies of milk products.

Zinc deficiency. Zinc is a mineral that is necessary for vitamin A to improve vision.

Prevention

Vitamin A may prevent night blindness and slow the progression of eye conditions, such as macular degeneration, which cause night blindness. Wearing sunglasses during the day can prevent eye damage.